AI Planning
Exercise Sheet 9

Date: January 9, 2015
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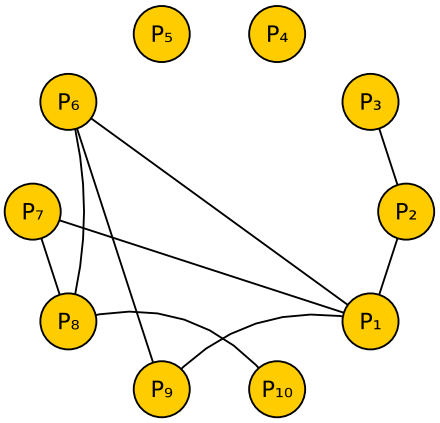
Exercise 9.1

(a) Compatibility graph:



Maximal cliques: $\{P_1, P_2\}$, $\{P_1, P_6, P_9\}$, $\{P_1, P_7\}$, $\{P_2, P_3\}$, $\{P_4\}$, $\{P_5\}$, $\{P_6, P_8\}$, $\{P_7, P_8\}$, $\{P_8, P_{10}\}$.

(b)

$$h^{\mathscr{C}} = max\{h^{P_1} + h^{P_2}, h^{P_1} + h^{P_6} + h^{P_9}, h^{P_1} + h^{P_7}, h^{P_2} + h^{P_3}, h^{P_4}, h^{P_5}, h^{P_6} + h^{P_8}, h^{P_7} + h^{P_8}, h^{P_8} + h^{P_{10}}\}$$
$$= max\{h^{\{at\text{-}goal_{s2}\}} + h^{\{at\text{-}goal_{s1}, position_{s1}\}}, h^{\{at\text{-}goal_{s2}\}} + h^{\{at\text{-}goal_{s1}, content_H\}} + h^{\{content_A, content_E\}}, h^{\{at\text{-}goal_{s2}\}} + h^{\{at\text{-}goal_{s1}, content_G\}}, h^{\{at\text{-}goal_{s1}, position_{s1}\}} + h^{\{at\text{-}goal_{s2}, position_{s2}\}}, h^{\{at\text{-}goal_{s1}, position_{s1}, position_p\}}, h^{\{position_{s1}, position_p\}}, h^{\{at\text{-}goal_{s1}, content_H\}} + h^{\{at\text{-}goal_{s2}, content_D\}}, h^{\{at\text{-}goal_{s1}, content_G\}} + h^{\{at\text{-}goal_{s2}, content_D\}}, h^{\{at\text{-}goal_{s2}, content_D\}} + h^{\{at\text{-}goal_{s1}, content_Q\}}\}$$

Algebraic implification:

$$h^{\mathscr{C}} = max\{h^{\{at\text{-}goal_{s2}\}} + max\{h^{\{at\text{-}goal_{s1}, position_{s1}\}}, h^{\{at\text{-}goal_{s1}, content_H\}} + h^{\{content_A, content_E\}}, h^{\{at\text{-}goal_{s1}, content_G\}}\}, h^{\{at\text{-}goal_{s1}, position_{s1}\}} + h^{\{at\text{-}goal_{s2}, position_{s2}\}}, h^{\{at\text{-}goal_{s1}, position_{s1}, position_p\}}, h^{\{position_{s1}, position_p\}}, h^{\{at\text{-}goal_{s2}, content_D\}} + max\{h^{\{at\text{-}goal_{s1}, content_H\}}, h^{\{at\text{-}goal_{s1}, content_G\}}, h^{\{at\text{-}goal_{s1}, content_Q\}}\}\}$$

Dominance pruning:

$$h^{\mathscr{C}} = max\{h^{\{at\text{-}goal_{s2}\}} + max\{h^{\{at\text{-}goal_{s1}, position_{s1}\}}, h^{\{at\text{-}goal_{s1}, content_H\}} + h^{\{content_A, content_E\}}, h^{\{at\text{-}goal_{s1}, content_G\}}\}, h^{\{at\text{-}goal_{s1}, position_{s1}\}} + h^{\{at\text{-}goal_{s2}, position_{s2}\}}, h^{\{at\text{-}goal_{s1}, position_{s1}, position_p\}}, h^{\{at\text{-}goal_{s2}, content_D\}} + max\{h^{\{at\text{-}goal_{s1}, content_H\}}, h^{\{at\text{-}goal_{s1}, content_G\}}, h^{\{at\text{-}goal_{s1}, content_Q\}}\}\}$$

(c) Obviously not reasonable is:

Pattern	Reason
P_9	random positions, no relevance for goal

Most likely not reasonable are:

Pattern	Reason
$P_{6-8,10}$	one goal relevant variable + random position
P_1	by itself reasonable, but included in P_3
P_5	by itself reasonable, but included in P_4

$h^{\mathscr{C}} = max\{h^{P_2} + h^{P_3}, h^{P_4}\}$

Exercise 9.2

Variables being connected in the CG means that they are relevant for modifying each other. If we start with P such that *all* its variables are causally relevant and P is causally connected and further pick v such that P' is *still* causally connected, then v cannot have been an intermediate node in the CG. It can only be the case that v in the CG was either (1) pointing at some variable still present in P' or (2) being pointed at by some variable still present in P' and pointing at γ.